INPUT/OUTPUT PORTS

UNCLASSIFIED

RISK ASSESSMENT: *Low*

SAFETY CONSIDERATIONS:

Electrical Shock Hazard

Electrostatic Discharge

ENVIRONMENTAL CONSIDERATIONS:

None

TERMINAL LEARNING OBJECTIVE

ACTION: Identify input/output port operations.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, NIDA electronic trainer, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on Memory operations.

ENABLING LEARNING OBJECTIVE

ACTION: Identify the operation of the user I/O Parallel port.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, NIDA electronic trainer, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on Memory operations.

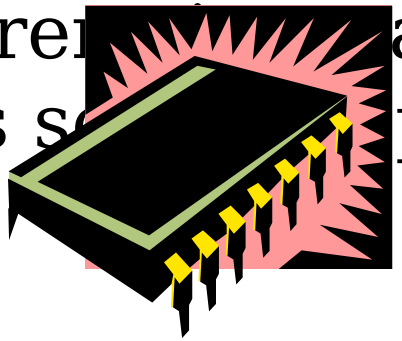
I/O PARALLEL PORT

U21, U22 – D-Type Latches

Lets data pass from the user bus to the port.

When the data is sent to the latches it doesn’t pass onto the LED’s until the control signals are sent.

Once its there it remains available until something else is sent to replace it.

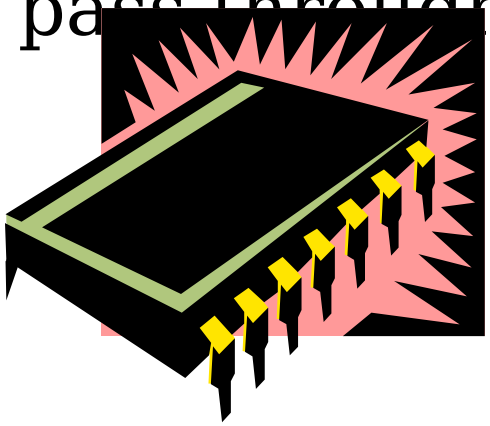


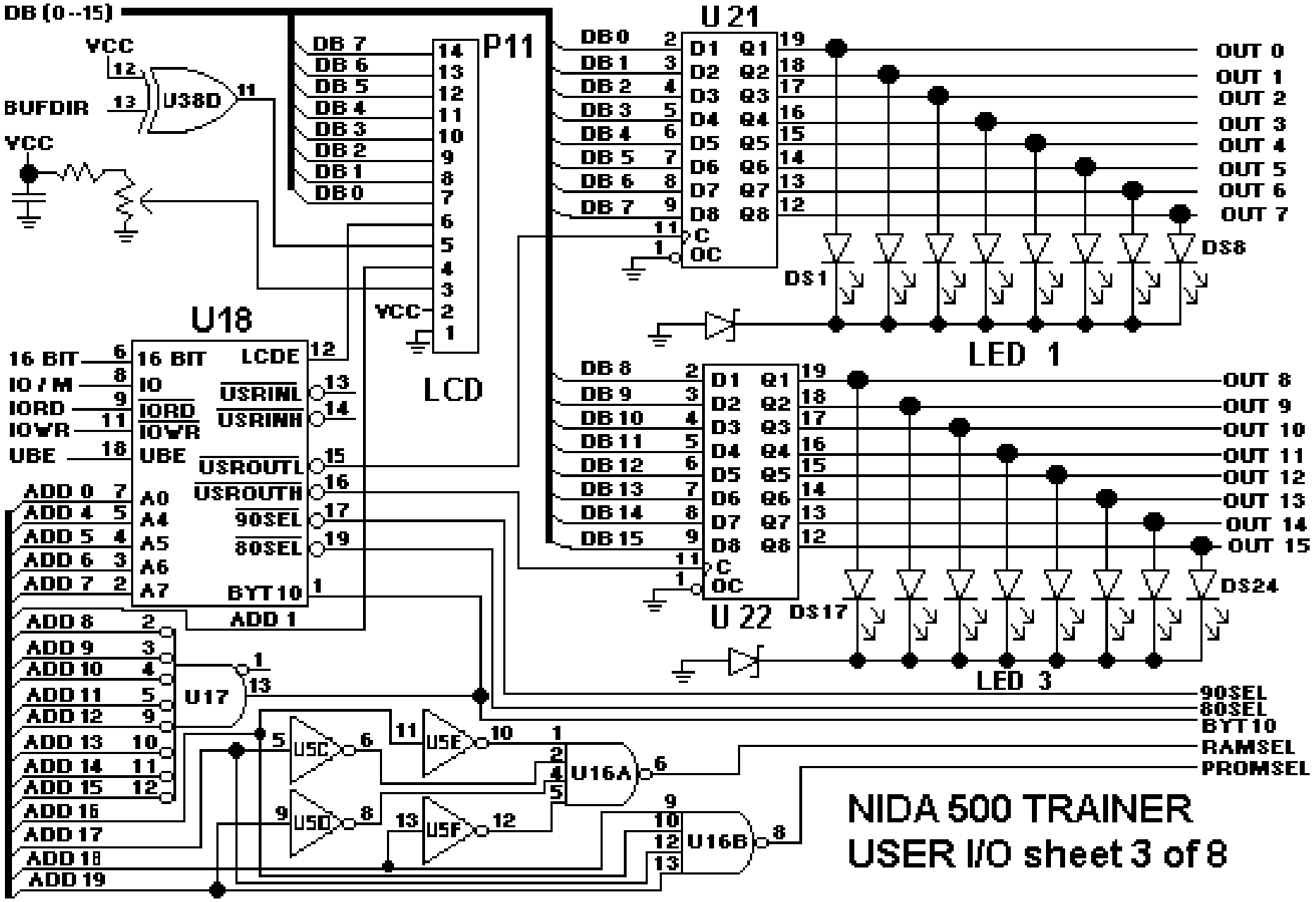
I/O PARALLEL PORT

U19, U20 – Buffers

Lets data pass from the port to the user bus.

When the data is present on the input lines it doesn’t pass until the control signals are sent to allow it to pass through the buffers.




DB (0--15)
VCC
BUFDIR
U38D
P11
LCD
U18
16 BIT
IO / M
IORD
IOWR
UBE
LCDE
USRINL
USRINH
USROUTL
USROUTH
90$EL
80$EL
BYT 10
ADD 1
A0
A4
A5
A6
A7
ADD 0
ADD 4
ADD 5
ADD 6
ADD 7
ADD 8
ADD 9
ADD 10
ADD 11
ADD 12
ADD 13
ADD 14
ADD 15
ADD 16
ADD 17
ADD 18
ADD 19
U17
U5C
U5D
U5E
U5F
U16A
U16B
U21
U 22
D1
D2
D3
D4
D5
D6
D7
D8
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
C
OC
OUT 0
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
OUT 12
OUT 13
OUT 14
OUT 15
D$1
D$8
D$17
D$24
LED 1
LED 3
90$EL
80$EL
BYT 10
RAMSEL
PROMSEL
NIDA 500 TRAINER
USER I/O sheet 3 of 8

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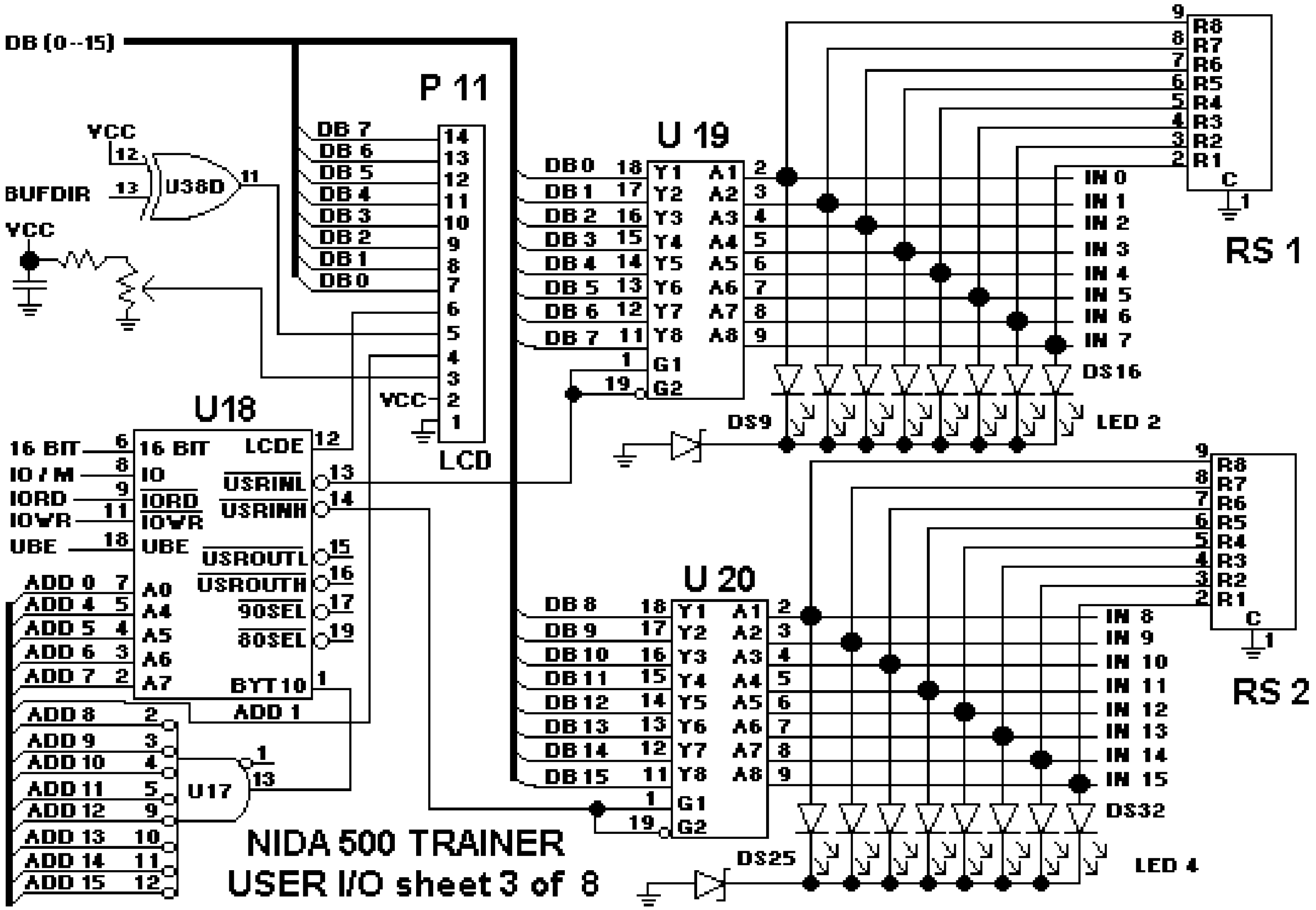
DB (0--15)
P 11
LCD
U 19
U 20
U18
U17
U38D
VCC
BUFDIR
RS 1
RS 2
LED 2
LED 4
DS16
DS9
DS32
DS25
IN 0
IN 1
IN 2
IN 3
IN 4
IN 5
IN 6
IN 7
IN 8
IN 9
IN 10
IN 11
IN 12
IN 13
IN 14
IN 15
R1
R2
R3
R4
R5
R6
R7
R8
16 BIT
IO / M
IORD
IOWR
UBE
LCDE
USRINL
USRINH
USROUTL
USROUTH
90SEL
80SEL
BYT 10
ADD 0
ADD 1
ADD 4
ADD 5
ADD 6
ADD 7
ADD 8
ADD 9
ADD 10
ADD 11
ADD 12
ADD 13
ADD 14
ADD 15
NIDA 500 TRAINER
USER I/O sheet 3 of 8

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U18 DECODER

The U4 sends control signals to the U18 to control the operation of the I/O port.

IO/M, I/ORD, I/OWR

The U18 uses these signals and UBE and A0 sent from the CPU to produce:

USRINL, USRINH, USROUTL, USROUTH

U18 DECODER

When addressing the output port 4 address lines are used to create the port addresses of 70 or 71.

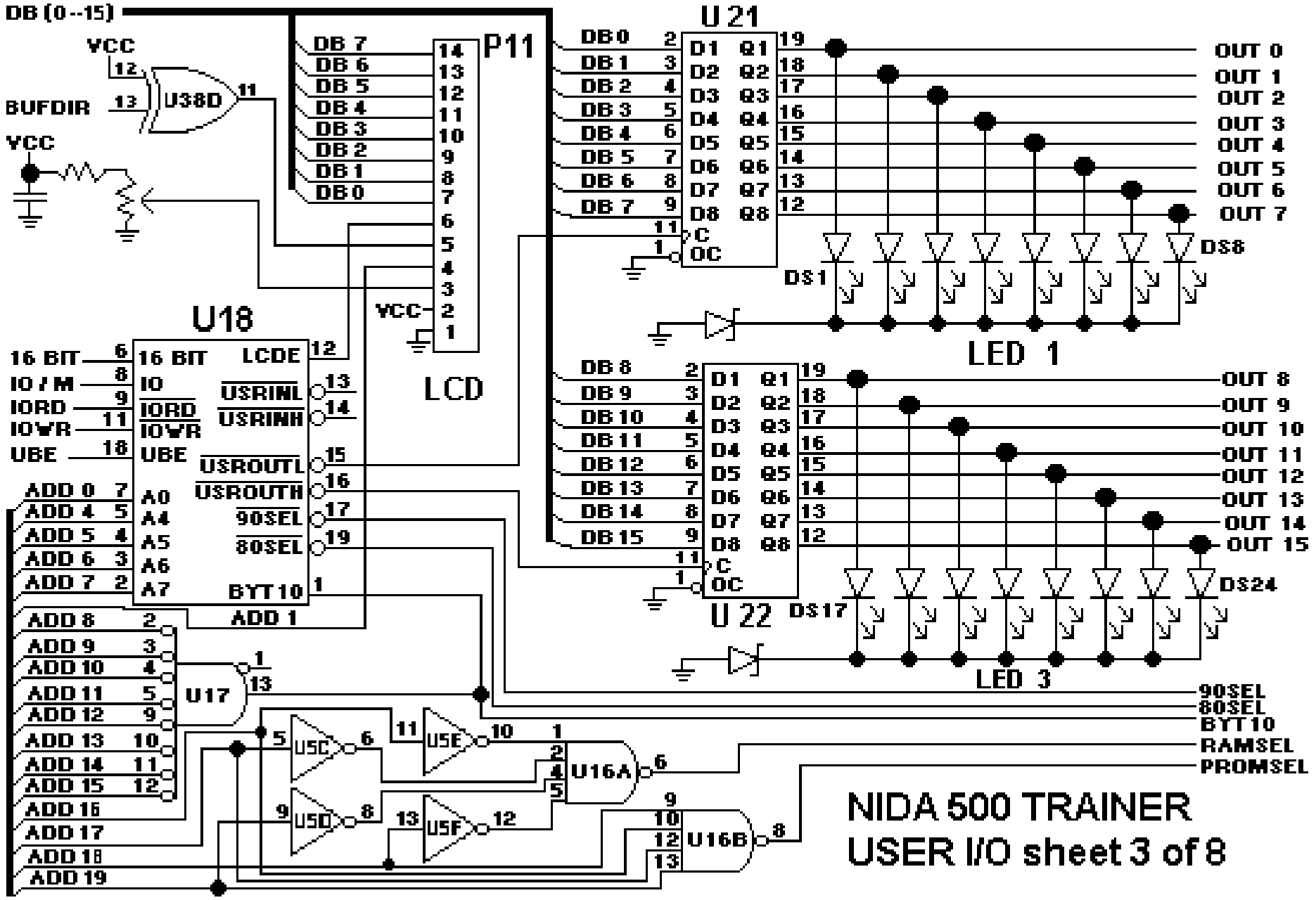
ADDRESS LINES

ADD4, ADD5, ADD6, ADD7 0 1 1 1 = 7

007Xh

The ADD0 is used to select the low byte portion of the port while the UBE is used to select the high byte portion of the port.

E6 70 = ADD0 low, UBE high E7 70 = both ADD0 and


DB (0--15)
VCC
BUFDIR
U38D
P11
LCD
U18
16 BIT
IO / M
IORD
IOWR
UBE
LCDE
USRINL
USRINH
USROUTL
USROUTH
90$EL
80$EL
BYT 10
ADD 1
A0
A4
A5
A6
A7
ADD 0
ADD 4
ADD 5
ADD 6
ADD 7
ADD 8
ADD 9
ADD 10
ADD 11
ADD 12
ADD 13
ADD 14
ADD 15
ADD 16
ADD 17
ADD 18
ADD 19
U17
U5C
U5D
U5E
U5F
U16A
U16B
U21
U 22
D1
D2
D3
D4
D5
D6
D7
D8
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
C
OC
OUT 0
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
OUT 12
OUT 13
OUT 14
OUT 15
D$1
D$8
D$17
D$24
LED 1
LED 3
90$EL
80$EL
BYT 10
RAMSEL
PROMSEL
NIDA 500 TRAINER
USER I/O sheet 3 of 8

ENABLING LEARNING OBJECTIVE

ACTION: Identify the operation of the user I/O serial port.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, NIDA electronic trainer, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on Memory operations.

I/O SERIAL PORT

Used to transmit data over long distances by the use of modems.

Modems were developed in the 1960’s so that computers separated by a vast distance could communicate with

I/O SERIAL PORT

Data can be transferred in one of two ways:

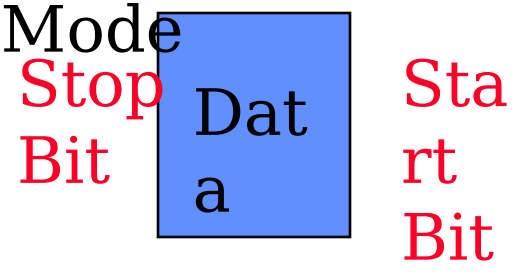
Synchronously

Asynchronously

In the synchronous mode, data is sent at a constant rate in blocks with bits to identify its start and end.

In the asynchronous mode each character is sent individually with bits to identify its start and end.

Synchronous Mode



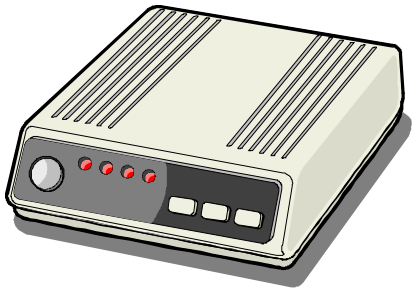
Asynchronous Mode

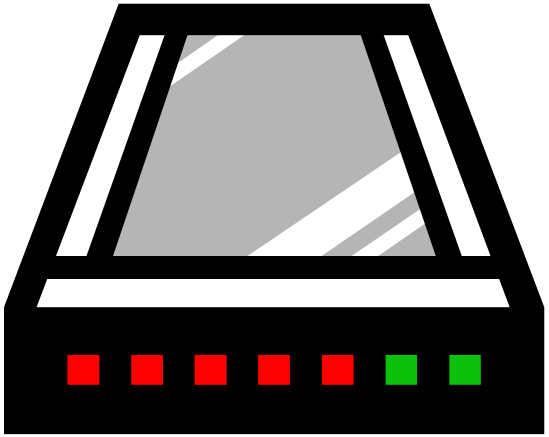
I/O SERIAL PORT

Baud Rate – is the number of changes per second that the hardware generates.

Data Rate – bits per second – is equal to or higher than the baud rate.

14000 baud x 4 bits per baud = 56 Kbps





ENABLING LEARNING OBJECTIVE

ACTION: Identify the RS-232 serial port circuitry.

CONDITIONS: Given a classroom environment, Computer Aided Instruction (CAI), workstation, NIDA electronic trainer, and official OMEMS reference material.

STANDARDS: Correctly answer 7 of 10 questions on Memory operations.

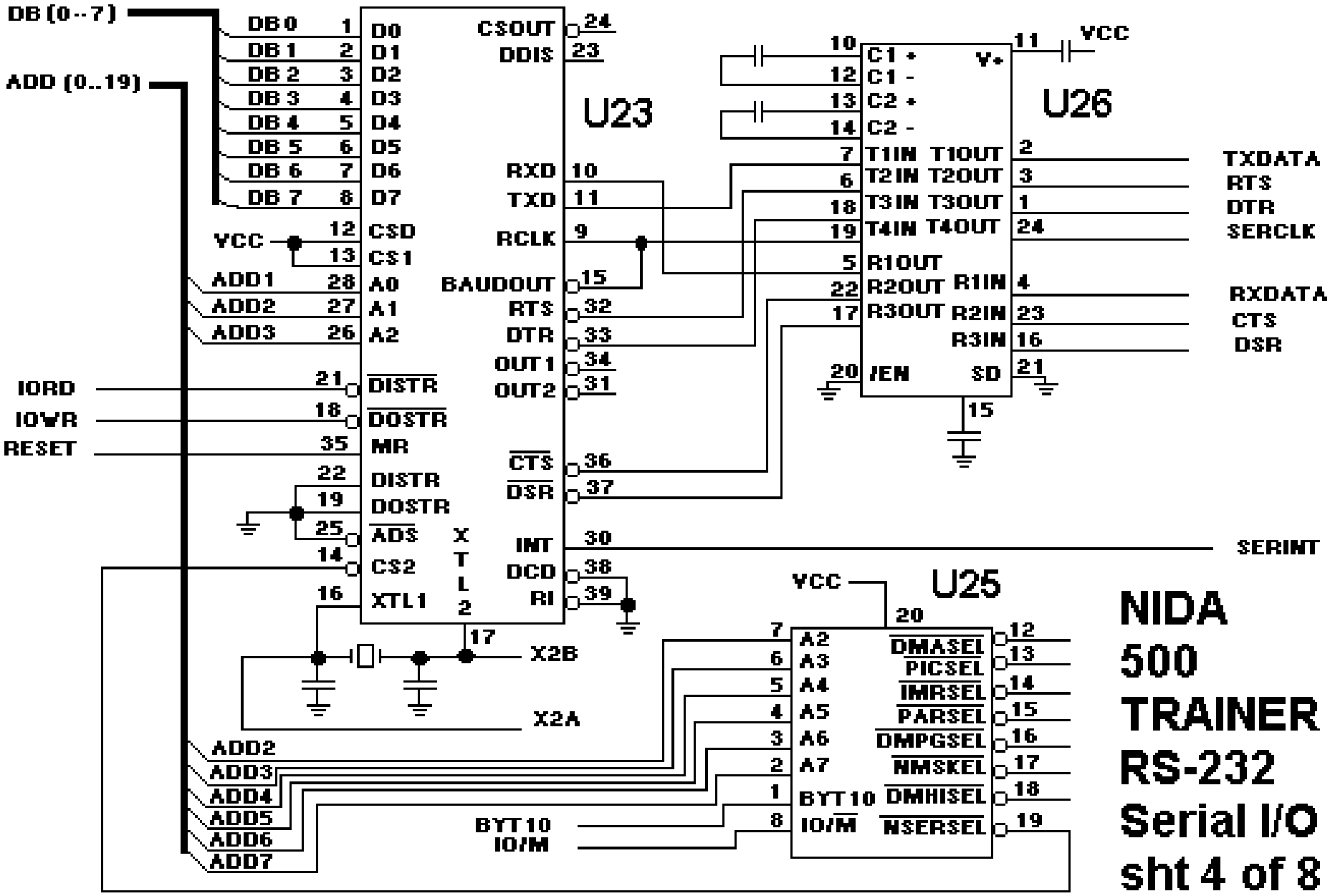
I/O SERIAL PORT

The trainer uses a common RS-232 serial port circuit. The components that make up the serial port are:

U23 – UART/BRG – Universal Asynchronous Transmitter and Baud Rate Generator. Used to receive or transmit the lower 8 bits of the data bus.

U25 – NSCPORT - used to select a particular I/O port.

U26 - Max 236 – ensures the signals are the correct levels for transmission and receiving.


DB (0--7)
ADD (0..19)
U23
U26
U25
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
D0
D1
D2
D3
D4
D5
D6
D7
CSOUT
DDIS
RXD
TXD
RCLK
BAUDOUT
RTS
DTR
OUT1
OUT2
CTS
DSR
INT
DCD
RI
CS0
CS1
A0
A1
A2
DISTR
DOSTR
MR
ADS
CS2
XTL1
XTL2
VCC
ADD1
ADD2
ADD3
IORD
IOWR
RESET
X2B
X2A
C1 +
C1 -
C2 +
C2 -
V+
T1IN T1OUT
T2IN T2OUT
T3IN T3OUT
T4IN T4OUT
R1OUT
R2OUT R1IN
R3OUT R2IN
R3IN
/EN
SD
TXDATA
RTS
DTR
SERCLK
RXDATA
CTS
DSR
SERINT
A2
A3
A4
A5
A6
A7
BYT
IO/M
DMASEL
PICSEL
IMRSEL
PARSEL
DMPGSEL
NMSKEL
DMHISEL
NSERSEL
ADD2
ADD3
ADD4
ADD5
ADD6
ADD7
BYT
IO/M
NIDA
500
TRAINER
RS-232
Serial I/O
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